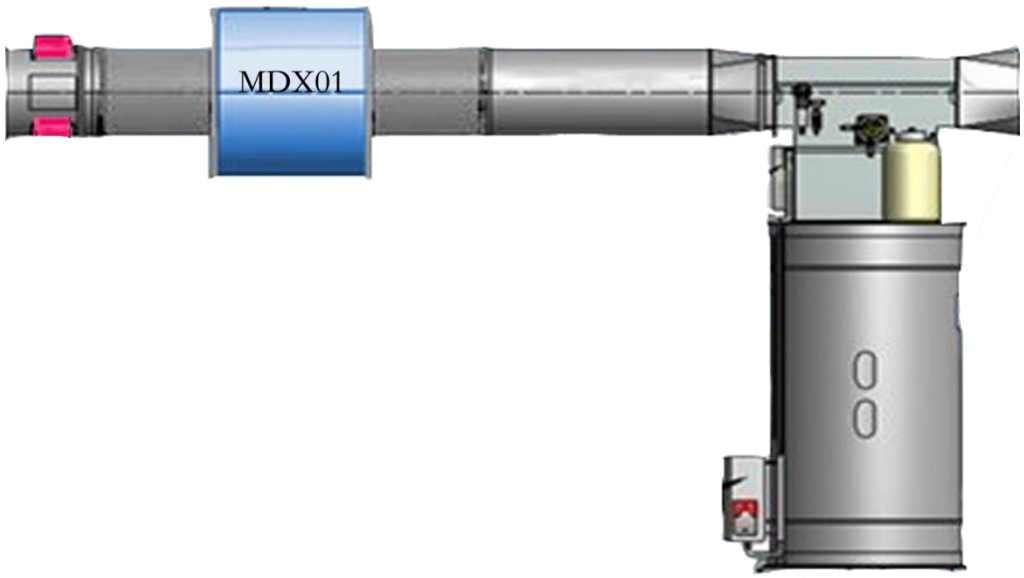
ABLT

Protect Production Lines from Fire & Damage from loose Metal



MDX01

Metal&Spark Diverter

User Manual

(Version 5.**)

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A. Overview

1. Use and structural features

MDX01 Metal and Spark Diverter is installed on the pipe of pneumatic transport systems for materials like fibers or tuft. It effectively detects metallic particles and sparks, mixed or generated in the production process.

Features

- Detects all kinds of metallic particles Ferrous and Non-Ferrous such as : Brass, Stainless Steel, Copper, Aluminum.
- Highly sensitive to infrared radiation emitted by fast moving small sparks in pneumatic transport systems for textile fibers.
- Intelligent identification of metals kinds, moving speed to ensure reliable elimination.
- Self-monitoring of actuator valve actuation time.
- Automatic recording the real time when the fire alarm happens.
- Automatic simulation and testing of spark detection system.
- Water spray system is available.
- Level sensor indicates when collection can is full.
- RS-485 Serial interface, communicate on Mod-bus networks.
- Easy installation.
- Metal is diverted into collector box and production is not interrupted.
- Operates in both positive and negative pressure.

2. Technical parameter

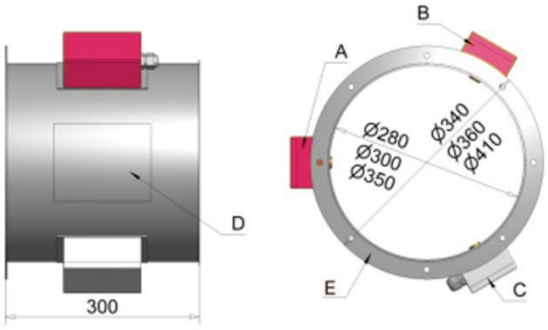
1）Sensitivity: Metal detection: Steel ball diameter more than Φ2mm
Aluminum ball diameter more than Φ4mm
Spark detection: Spark diameter more than Φ0.5mm spark
2）Response time: ≤150ms
3）Power supply: AC220V±10%，50HZ
4）Compressed air pressure range: 600～800KPa
5）Sound level of alarm: >60db
6）Power: <100VA
7）Requirement of the environment:
temperature -10℃—40℃, relative humidity（20-75）%RH

B. Electric wiring and installing

. Please be sure to read this “User manual” carefully before installation. And the installation environment and conditions for further correct measurement and evaluation.

1. Installing

1.1 The installation of the connecting pipe of spark detectors



A） Spark detectors

B）-X95 junction box

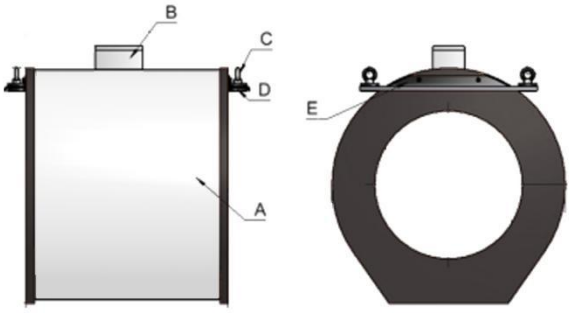
C）Flange

D）Observation window

Figure 1：The connecting pipe of spark detectors

The connecting pipe of the spark detectors can be installed to the pipeline directly, a side connected with the existing pipeline by flange, the other side connected with the glass steel pipe by a clamp.

1.2 The installation of the metal detector



A）Metal detectors

B）-X90 junction box

C）Hoisting ring

D）Insulating washer

E）Hanging support

Figure 2: Parts and dimension of the metal detector

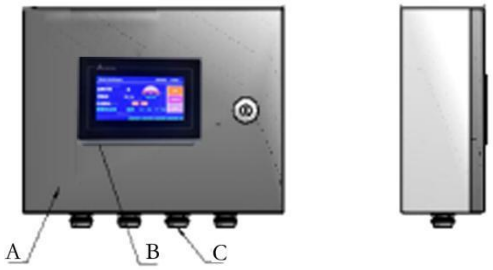
1) Metal detector can be hung up at the four hoisting rings by metal rods. Metal detector should be installed firmly, to avoid incorrect detecting caused by the vibrating.

2) Make sure the shielded cables for signal receiving and transferring between the metal detector and control box is connected reliably， then fix it without vibrating .

Connector cables are part of the sensor and have to be protected against interferences.

3) Metal detector should keep a certain distance from the things that generate the electromagnetic radiation such as electric motor, transformer and fluorescent lamp etc. Furthermore, it should keep a certain distance from big moving metal object. The cables with big current should be also kept a distance from the detector.

1.3 The installing of control box



A） Control box

B） Control panel

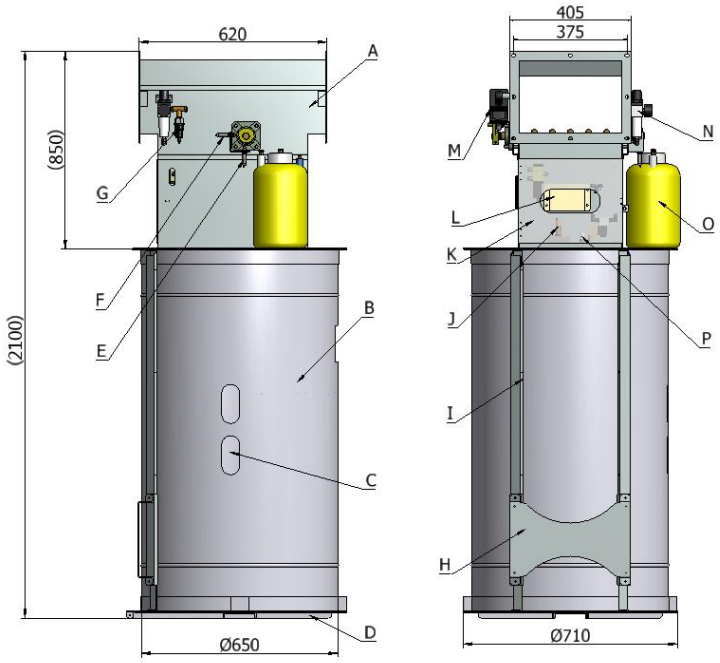
C） Cable Gland

Figure 3： Parts and External dimension of control box

Usually the control box is installed on the Support of the control box (Figure 4.H). Of course you can also install control box on the nearby wall .

1.4 The installing of actuator unit

The actuator unit is composed of two parts: diverter and collector box （refer to Figure 4） .The collector box is installed under the diverter and be careful not to reversely installed and assure that the door (Figure 4:D) can act flexibly.



A) Diverter **B)** Collector box

C) Observation window **D)**Door

E) Proximity switch(Activated)

F) Proximity switch(Normal)

G) Pressure sensor

H) Support of control box

I) Wiring ducts

J) Photoelectric switch

K) Diverter controller

L) -X98 junction box

M) Cylinder

N) Air filtration reducing valve

O) Water storage tank

P) Water spray nozzle

Figure 4: Parts and external dimension of actuator unit

The diverter is connected to the existing pipeline by square to round joint pipe and installed with metal rods, and when installing, pay attention to the direction of inlet and outlet. Because the diverter adopts the fast reaction pneumatic mechanism, 600～800kPa stable and clean compressed air must be provided.

The photoelectric switch is used to be a level sensor. It indicates when collector box is nearly full.

When the displayer is show “The collector box is full”, the collector box must be emptied immediately.

⚠ ATTENTION!

The collector box should be installed to a proper site to avoid the diverted material falling on the cotton bale or other machines, when the door of the collector box is opened.

⚠ ATTENTION!

When emptying the collector box, the bottom of the diverter (especially the movable flap) may not be touched! There is danger on injury due to sudden movement parts.

1.5 The standard installation

MDX01 can be installed according to the Figure 5 if the materials transporting speed is in the range of 10m/s to 20m/s.

Before installing the MDX01 you need to calculate the right distance between the metal detector and the diverter. You can do this with the following formula.

Distance[m]= Transport velocity[m/s]*Reaction time[s]*Safety factor

The **Distance** is the metal detector to the diverter.

The **Transport velocity** is the material transport velocity in the pipeline.

The **Reaction time** is defined as the time taken by diverter to reach activated position after receiving a switching impulse.

The range of the **Safety factor** is 1.2~1.3.

The ‘ I ’ in the following figure 5 is a piece of connection pipe, it should be supplied by customer. The length of the pipe is normally from 1.6m to 4m, corresponding to transport velocity from 10m/s to 25m/s;

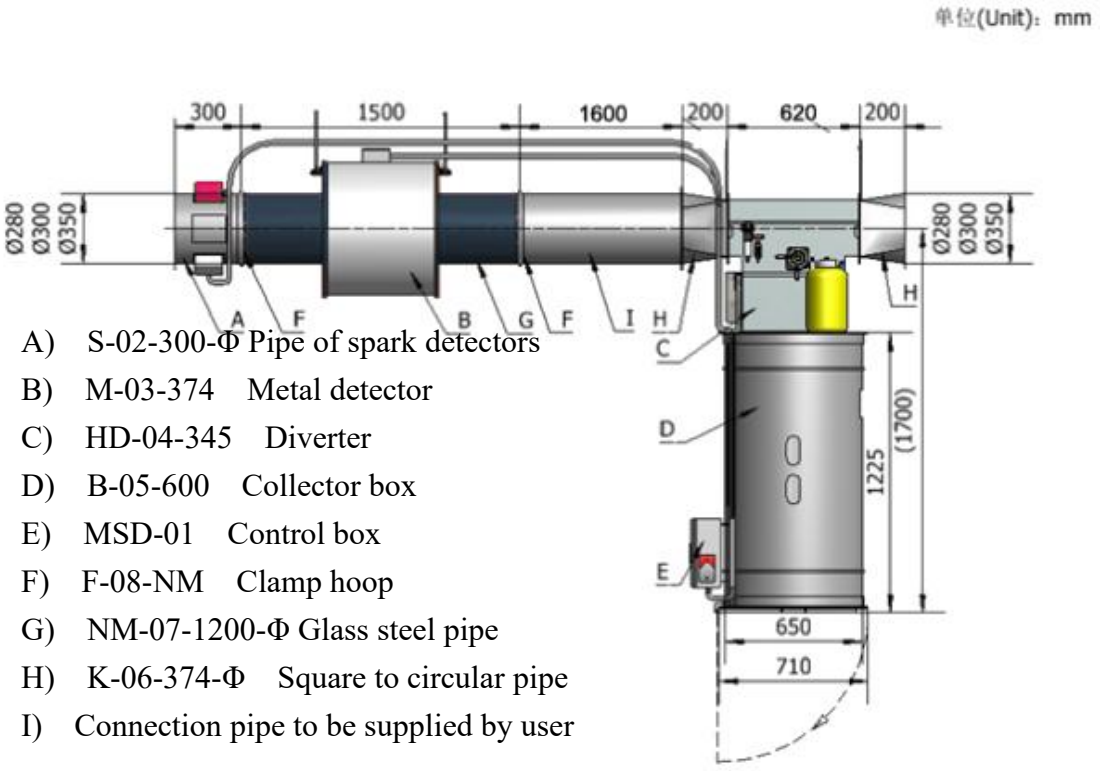


Figure 5：Standard Installation

2. Electric wiring

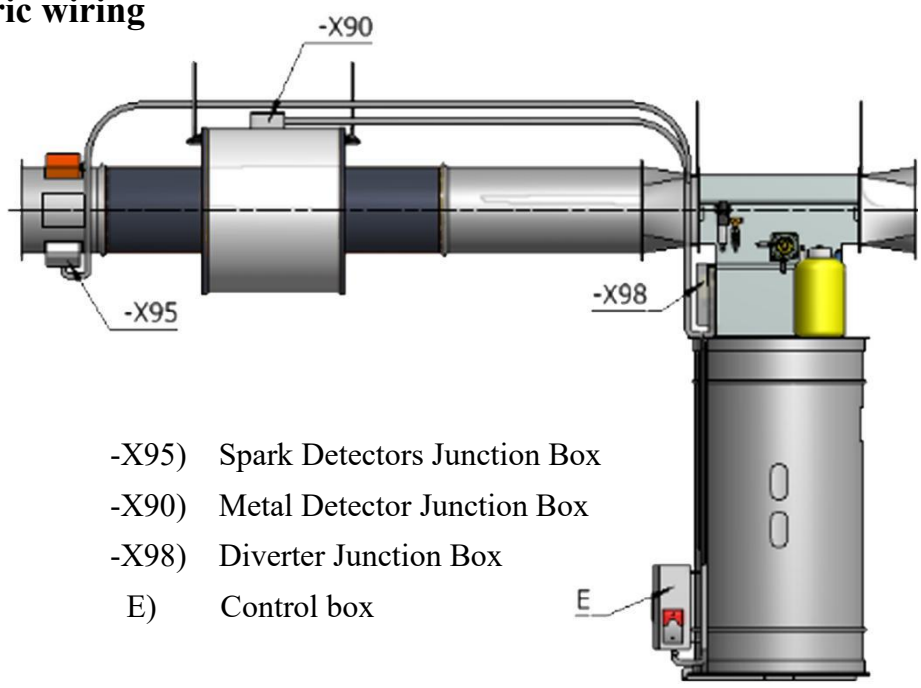


Figure 6 a: Electric wiring of the standard installation

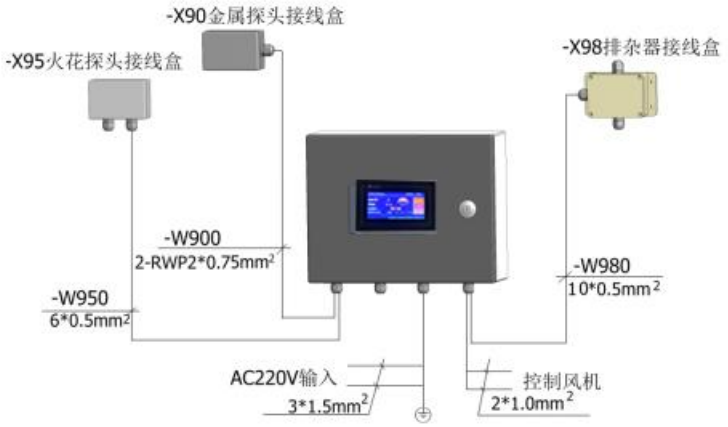


Figure 6 b: Electric wiring of the control box

2.1 Internal wiring of control box

The touch screen's RS232 interface is connected with the control board's RS232 interface; touch screen power supply: terminal "24V" and terminal "0V" are connected to terminal "24V" and terminal "GND" of J5 on power supply board.

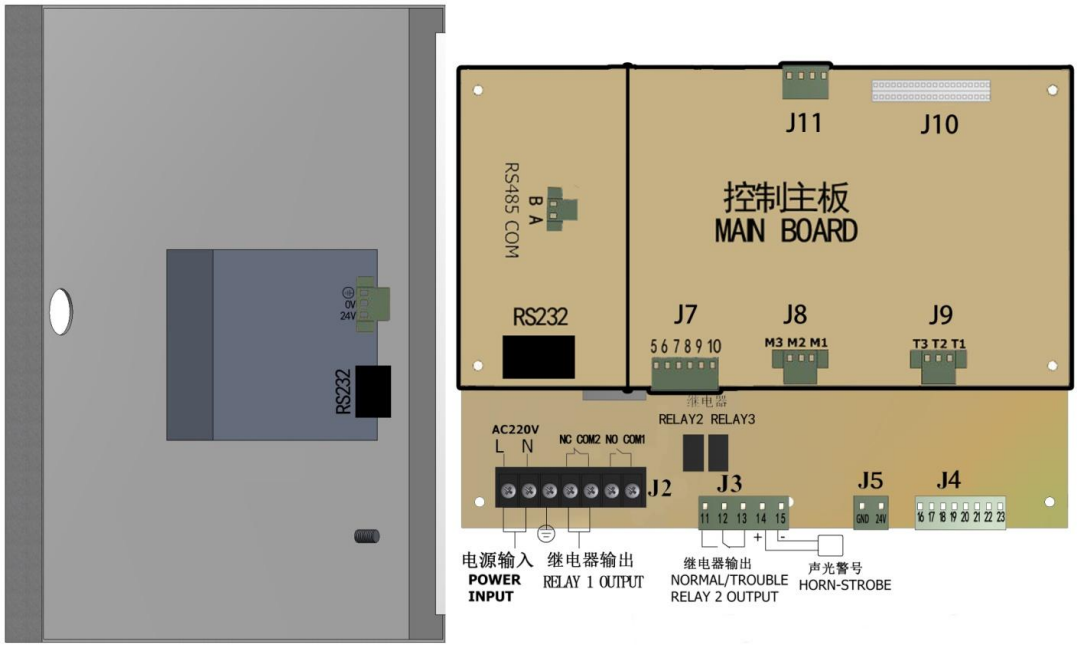


Figure 7: Wiring terminals in the control box

2.2 Control box power and interlock signal terminal J2

1）Terminal L and N of J2 are connected to AC 220V power line, ⏚ is ground lead.

ATTENTION

1、The power supply should be avoided being cut off when spark alarm stopping happens;

2、The power supply wiring should come from power distribution cabinet in the workshop, do not use AC 220V from control transformer of the electrical control cabinet. We shall avoid the share of power supply with other equipment that may produce interference radiation, such as high-power inverter and motor's frequent start-stop. Please provide separate power supply if possible.

2）Terminal "NC" 、 "COM2" and terminal "NO" 、 "COM1" are two sets of relay passive contacts of Relay1, terminal "NC" and "COM2" are a group of normally closed contacts, terminal "NO" and "COM1" are a group of normally open contacts.

Relay1：interlocking relay(it works when spark sensor detects sparks.)

The contact load: U~ 250V 、 I 5A, normal operation :

sparks be detected:

ATTENTION

Grounding and safety

1.All the units must be grounded directly to a common ground terminal according to the safety standard of local government.

2.This equipment needs to be separately grounded and it is prohibited to be grounded together with others. It is suggested that the grounded wire be as short as possible.

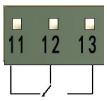
3.While overhauling, please first shut down the power supply and interrupt the compressed air supply. The temperature of the radiator is very high, don't touch it to

avoid burn.

2.3 Electrical wiring of J3 terminal

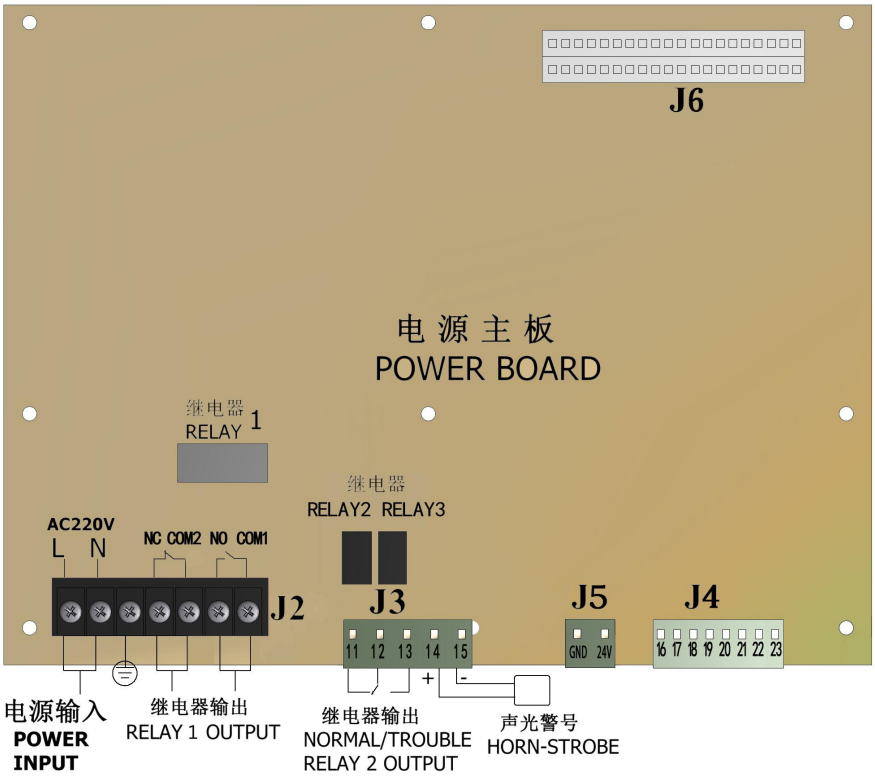
1)Terminal 11,12 and 13 are the output contacts of ready relay 2. It is to detect working condition of the machine. The relay2 is closed when all the sensors works normally.

Relay2：Ready delay.

The contact load: U~ 125V、I 0.6A, normal operation : 

fault or power off

2)Terminal 14 and 15 of J3 are connected to sound-light alarm signal, Terminal 14 is connected to the positive terminal, terminal 15 is connected to negative terminal.



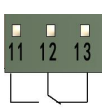


Figure 8. Electrical wiring of power board

2.4 Control box main board connected to metal detector

The -X90 wiring terminals in the metal detector junction box is connected to the

control box main board through 2 shielded cables, in which the wiring terminals [1 2 3] is connected to the transmitter cable (TX - cable) ; The wiring terminals [4 5 6] is connected to the receiver cable (RX - cable). (as shown in figure9)

2.5 Control box main board connected to spark sensor

The spark detector assembly contains three spark sensors, terminal J7 of control box main board is connected to -X95 aviation plug on spark detector module through multi-core cable-W950.

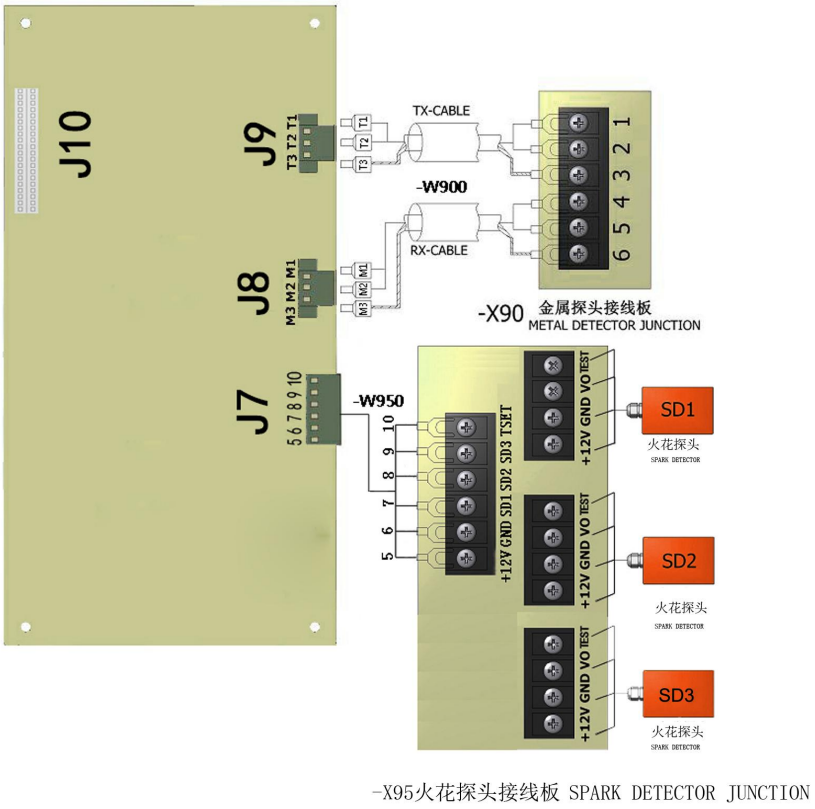


Figure 9: Electric wiring of the main board

2.6 Control box connected to diverter

The J4 on the power board of the control box is connected to the junction box -X98 of the diverter through multi-core cable.(The multi-core is made of 8 cables

which marked with “16 to 23”)

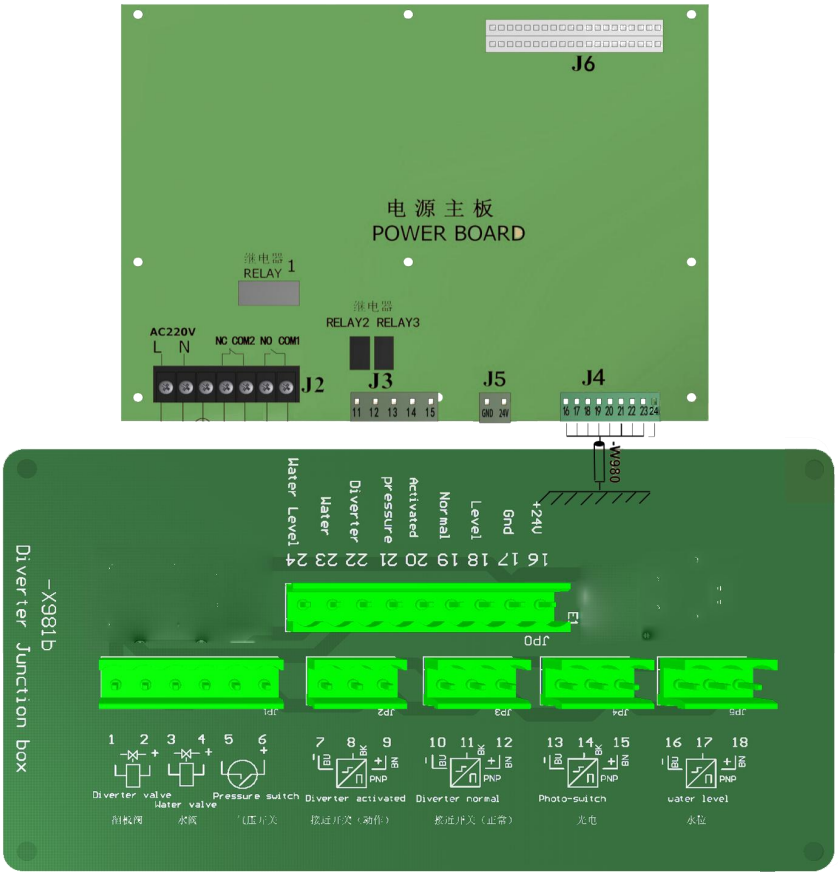


Figure 10: Electric wiring of the control box to diverter

2.7 Grounding and safety

1) All the units must be grounded directly to a common ground terminal according to the safety standard of local government.
2) This equipment needs to be separately grounded and it is prohibited to be grounded together with others. It is suggested that the grounded wire be as short as possible.
3) While overhauling, please first shut down the power supply and interrupt the compressed air supply.
4) After the fire alarm is activated, you should shut down the general power supply of the procedure and then put out the fire.
5) The function test or maintenance work that needs climbing should be carried out by more than two people.
6) Ensure the safety of personnel when testing the turning action of the actuator.

C. Using of the control panel

1. Operation panel display and function description

1.1 Touch screen (HMI)display description

1）Boot screen

Figure 11. Boot screen

“MDX01”is product model, “Ver 5.02”is software version model.

2）Work picture (main page)

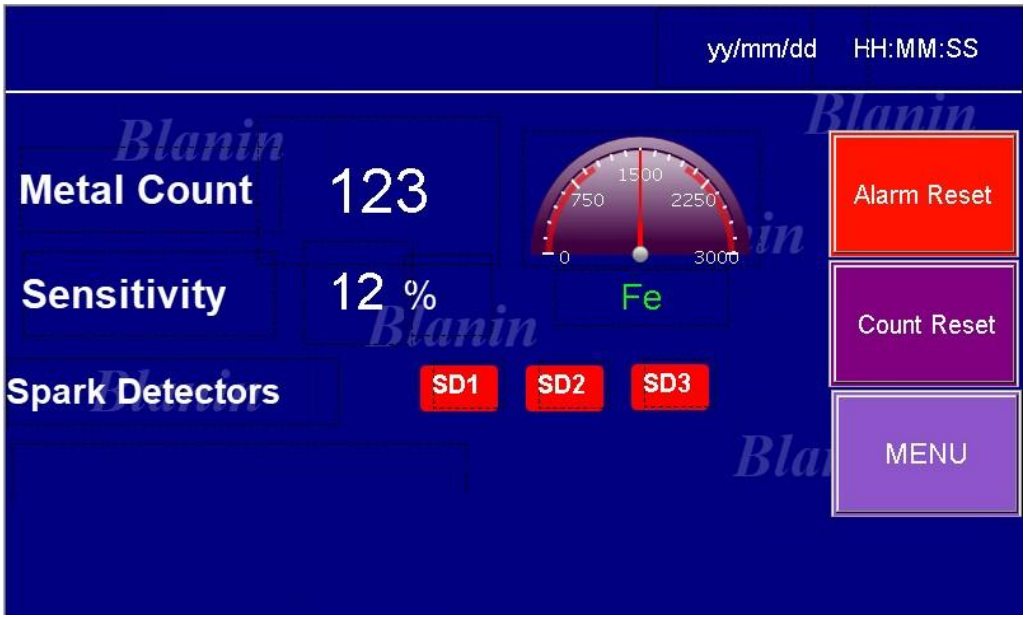


Figure 12. Work Page (main page)

Note: After startup, system enters work homepage automatically. System should return into work homepage after doing menu settings. System return into homepage automatically when under the condition of spark and metal alarm.

Panel displays	description
Metal count 10	Total metal detection counting is 10
Sensitivity 69%	Metal detection sensitivity(0%~99%), The current value is 69%
Spark detectors SD1 SD2	Represents the working state of SD1, SD2 sensors
Alarm reset	Alarm reset key
Count reset	Zero metal count
menu	Click it into menu

Table 1 :Description of touch screen content

3）HMI frame when detects metal materials

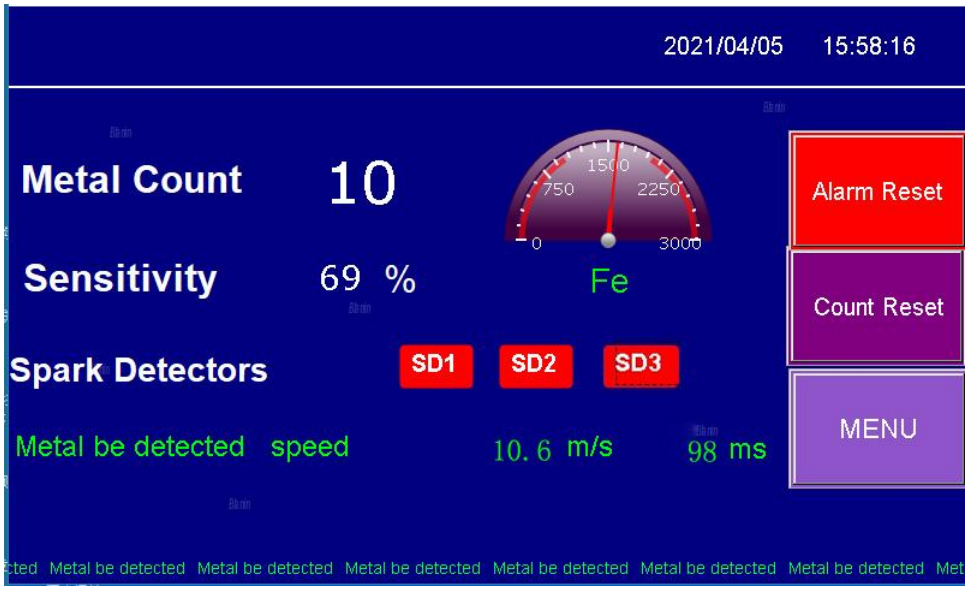


Figure 13. Detect metal material

When MDX01 detects metal material, screen displays the context “Metal be detected, speed 10.6 m/s 98ms”. It means that the speed of metal flow speed is 10.8m/s, the speed of the metal is for reference only. Due to the different size, shape and nature of the metal, there may be errors compared with the actual speed;

"Non-Fe" means non-ferromagnetic metal and "Fe" means ferromagnetic metal;

“98ms” means the actual action time of the actuator; the bottom of the HM displays the flow alarm message “metal be detected”.

4）HMI　frame when detects sparks

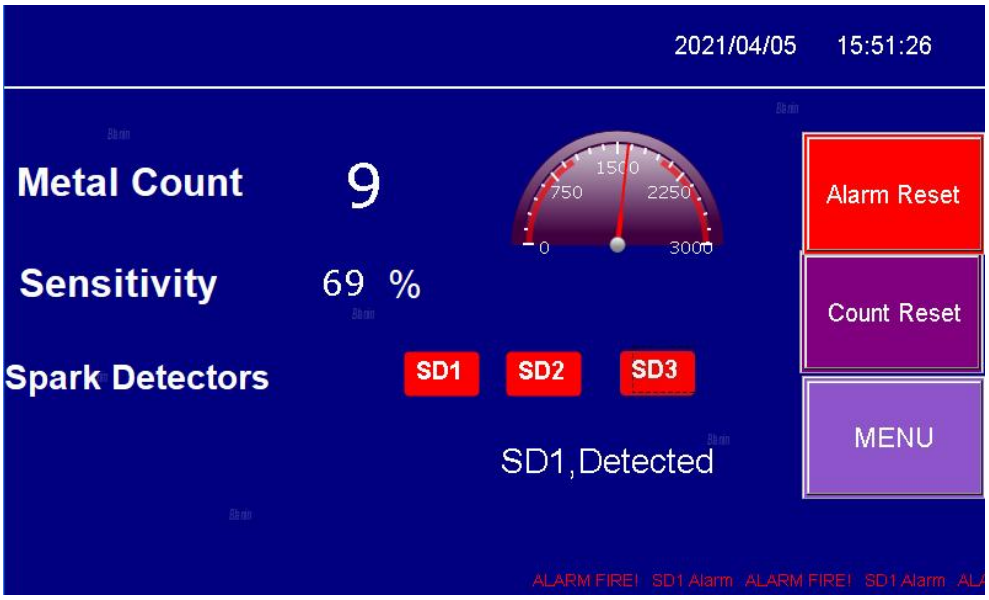


Figure 14. when detects spark

When sensor detects sparks, screen displays the context “SD1, detected”, it means spark sensor 1 first detects the spark, the bottom of the display screen displays the flow alarm message "ALARM FIRE!".

1.2 Menu description

Click “main menu” in the work home page to enter into the main menu page.

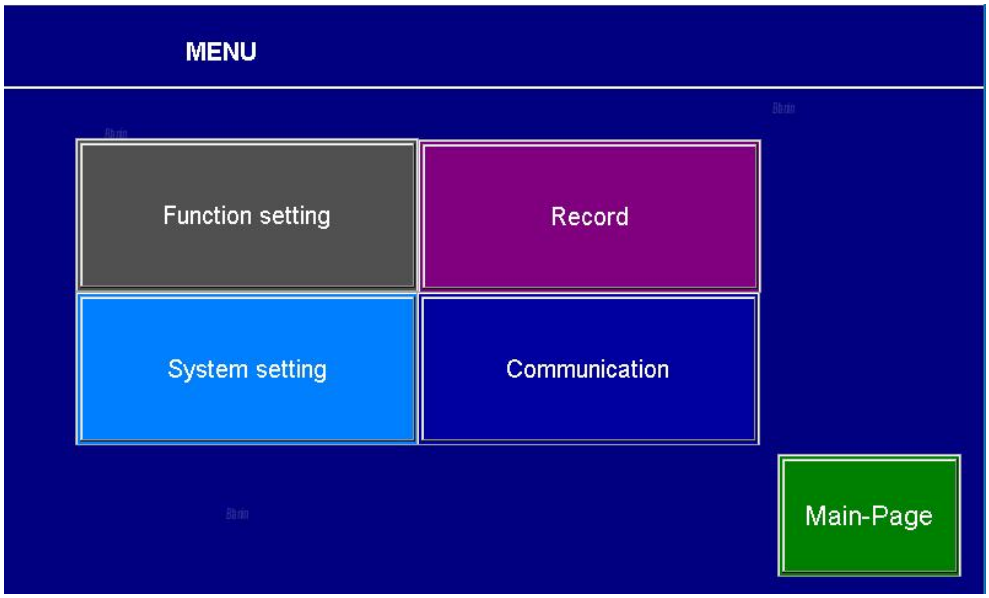


Figure 15. main menu page

Main menu has four sub menus including function setting, history, system setting and communication.

Click the “main-page” button to return to the home page

2. Parameter setting instructions

2.1 Function setting

Click “function setting” key to enter into parameter setting screen, the entry password is level 1 or above

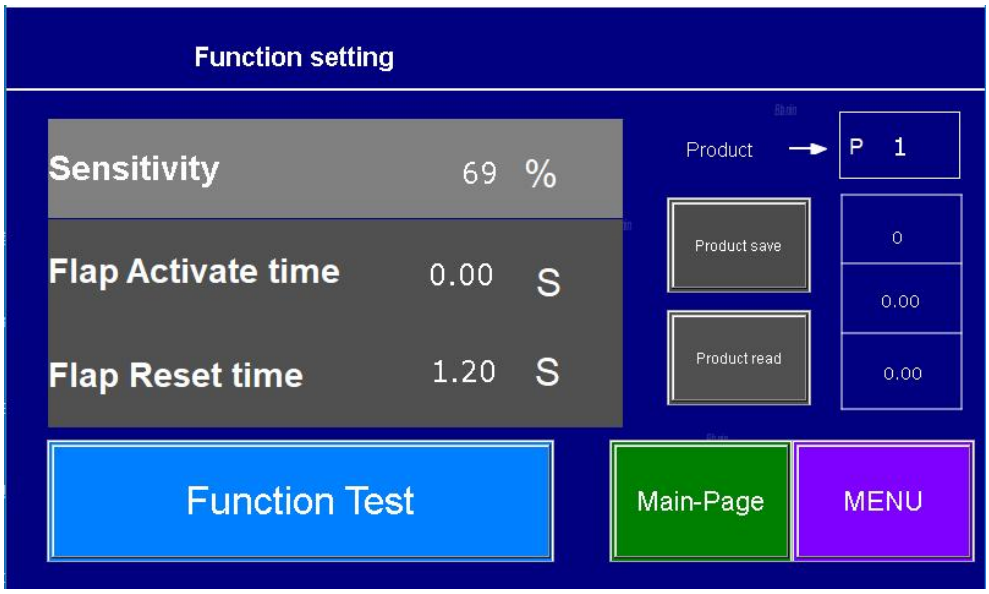


Figure 16. Function setting

Parameter	Setting range	Factory set value
Metal sensitivity	0-99%	69%
Delay action	0.00s-3.00s	0.00s
Delay reset	0.50s-3.00s	1.50s

Table 2: function setting table

2.1.1 Metal detection “sensitivity” parameter description:

① The metal detecting Sensitivity Parameter range is 0-99%,the lowest is 0 and the highest is 99%. The percentage is higher, the sensor is more sensitive.

ATTENTION

When the sensitivity is set to 0%, the metal detection function will be turned off.

② Enter the function setting parameters page, click the sensitivity value key, sensitivity set value is 0~99%.You can set the sensitivity parameter according to the actual requirement. The value in the range 40-75% can satisfy most of the users in spinning mills.

③ Sensitivity parameter can be set in home page, the setting method is the same as ②, the entry password is the same as the entry password of "function setting", the entry password is level 1 or above.

2.1.2 Click “Function Test” key and enter into function test page.

(Note: when “Spark Detectors Configuration” and “Diverter Standard Configuration” function are shut down, “Function Test” is shut down. It is configured before delivery.)

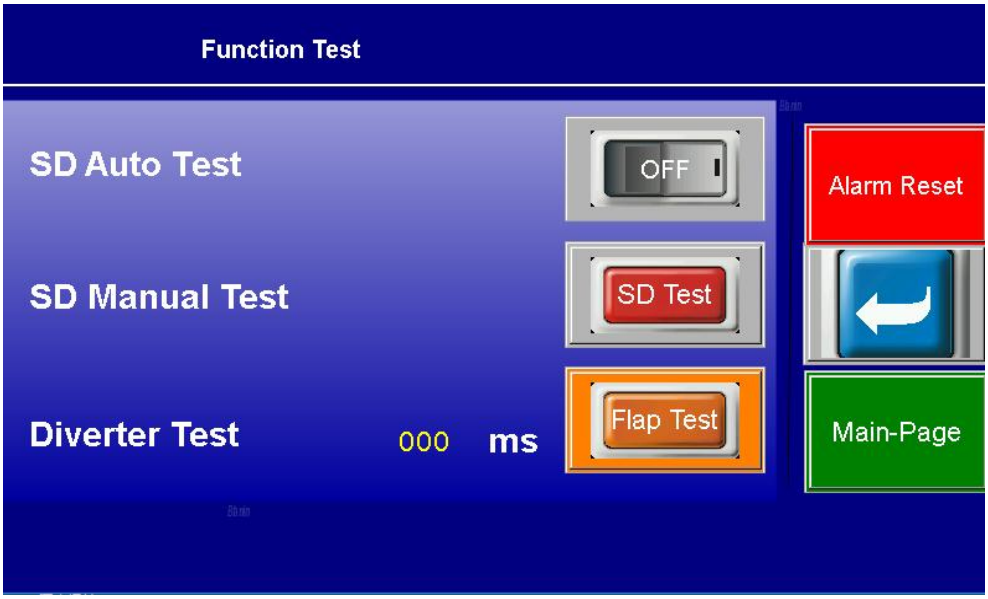


Figure 17.a. function test page

② “SD Auto Test”: spark sensors will do a self-test every 4 fours;

② “SD Manual Test”: click “SD Test”key, test spark sensor function manually. There will be a hint “End of spark test” after testing. When there is a fault in the spark sensor, the bottom of the page displays a fault such as "E10 SD1 fault ". E10 : there is fault in SD1.

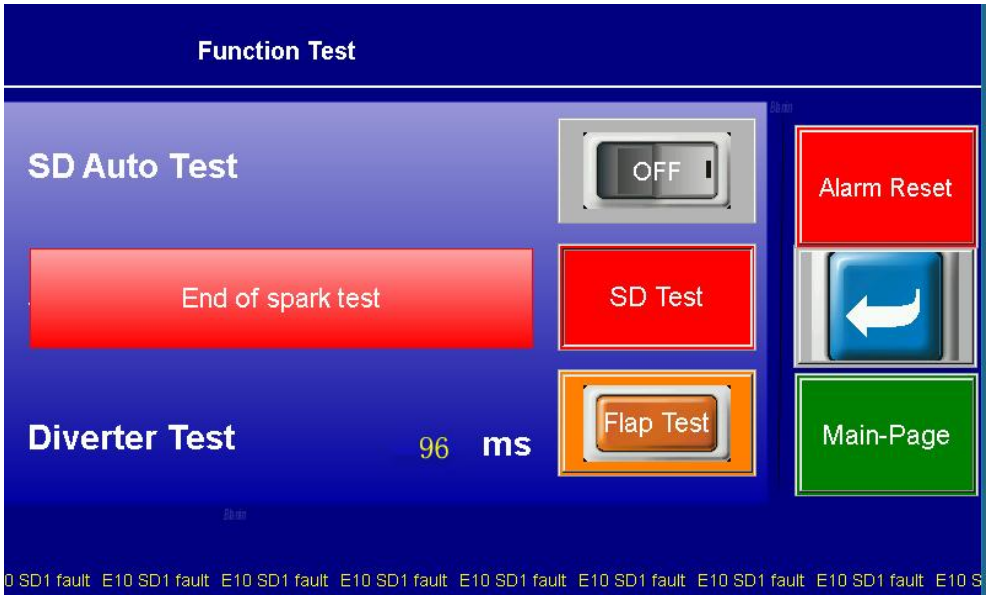

Function Test
SD Auto Test
OFF
Alarm Reset
End of spark test
SD Test
Diverter Test
96 ms
Flap Test
Main-Page
0 SD1 fault E10 SD1 fault E10 SD1 fault E10 SD1 fault E10 SD1 fault E10 SD1 fault E10 SD1 fault E10 SD1 fault E10 S

Figure 17.b. display of spark sensor manual test fault

③ “Diverter Test 96ms”: click “Flap Test” key and test actuator. It displays the flap actuation time after action.

CAUTION

Flip action test function may lead to danger, please ensure that the actuator is not being maintained by the maintenance personnel and that this function can only be used under the premise of no personal injury.

2.2 System setting

Click “ system setting” key and enter into system setting page. The entry password is level 2 or above.

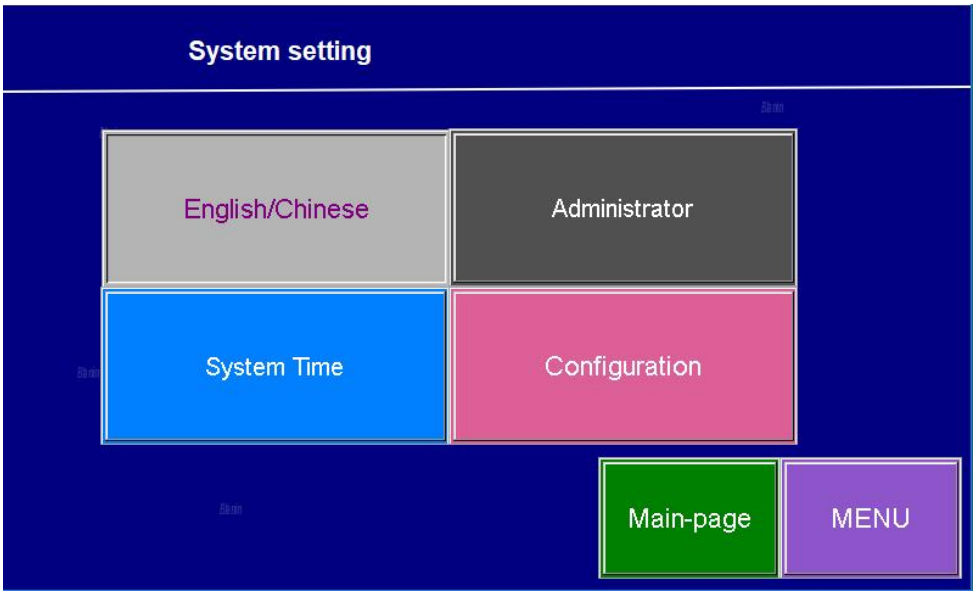


Figure 18. System setting

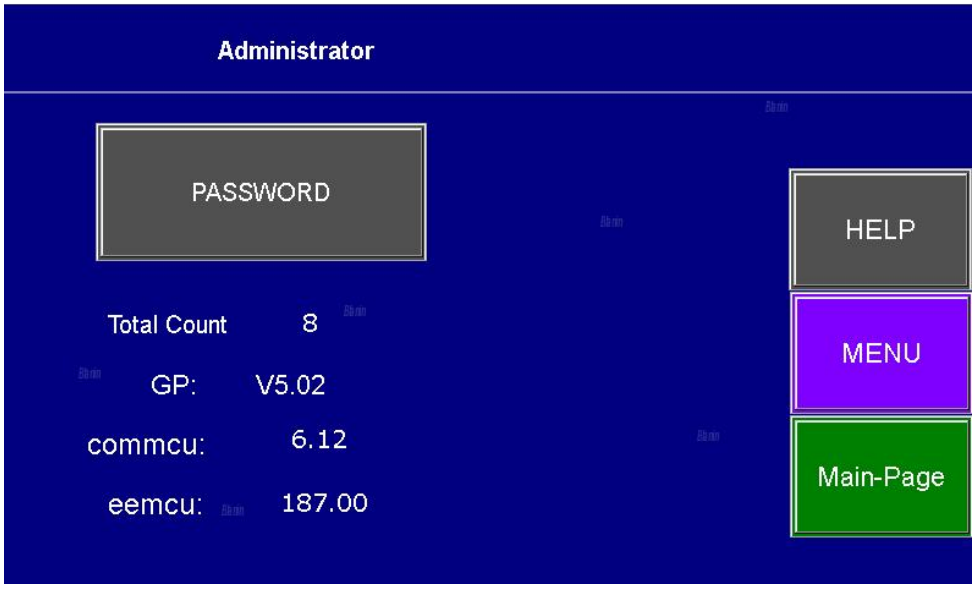


Figure 19.a: administrator screen

1) “English/Chinese”: it will switch the language of the system.

2) “System Time”: click the key and change the system time.

3) “Administrator”: The entry password is the administrator level 3.

Total Count 8	Metal detection’s total count is 8
GP: V5.02	Touch screen software version model:
Commcu：6.12	Communication board version model
eemcu：187.00	Main board version model
Help	Password level description

Table 3: administrator screen

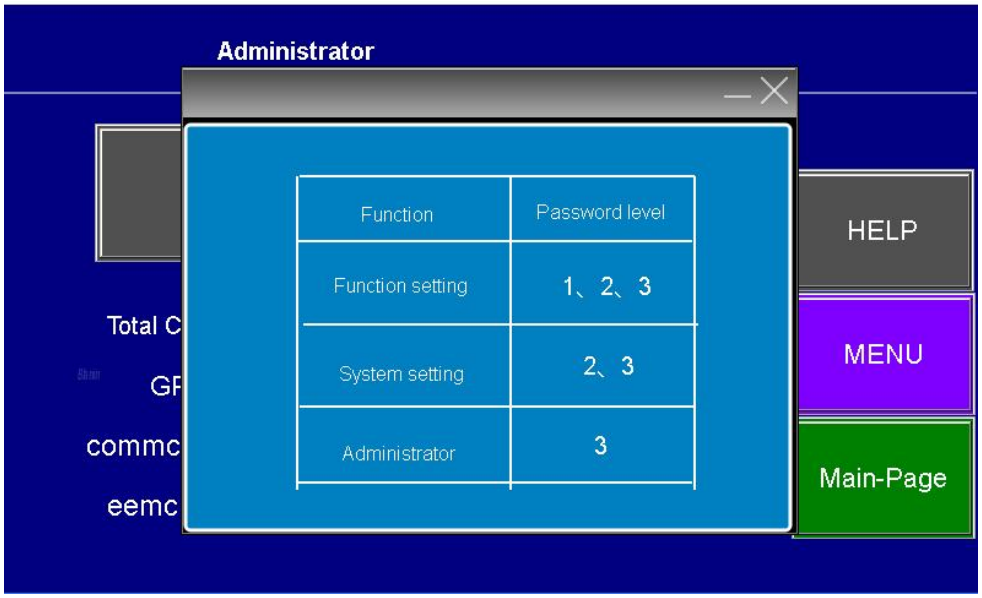


Figure 19.b Help menu

4) password level description: this product is open to users with three levels of passwords, including level 1, 2 and 3. The level 3 password is administrator level password and administrator level password is downward compatible with low-level password. The level 1 password can enter into “sensitivity setting” page, the second level password can enter into “system parameter setting” page and “communication

parameter setting" page, the level 3 password (administrator level password) can enter into "password setting". Users can modify level 1, 2 and 3 passwords.

5)system configuration: users can open or close "Spark Detectors Configuration" and "Diverter Standard Configuration" function according to demand. Spark detection function is shut down when "Spark Detectors Configuration" is off. Sensor and fault determination functions of standard actuators are shielded when "Diverter Standard Configuration" is off. "Diverter Standard Configuration" can be shut down if use non-standard actuators.

ATTENTION

The entry password of "Configuration" is level 4 or above all. The system configuration has been set before delivery; system configuration is related to the hardware configuration of the system and users do not need to set. If users need to change system configuration or shield some function, please contact our company.

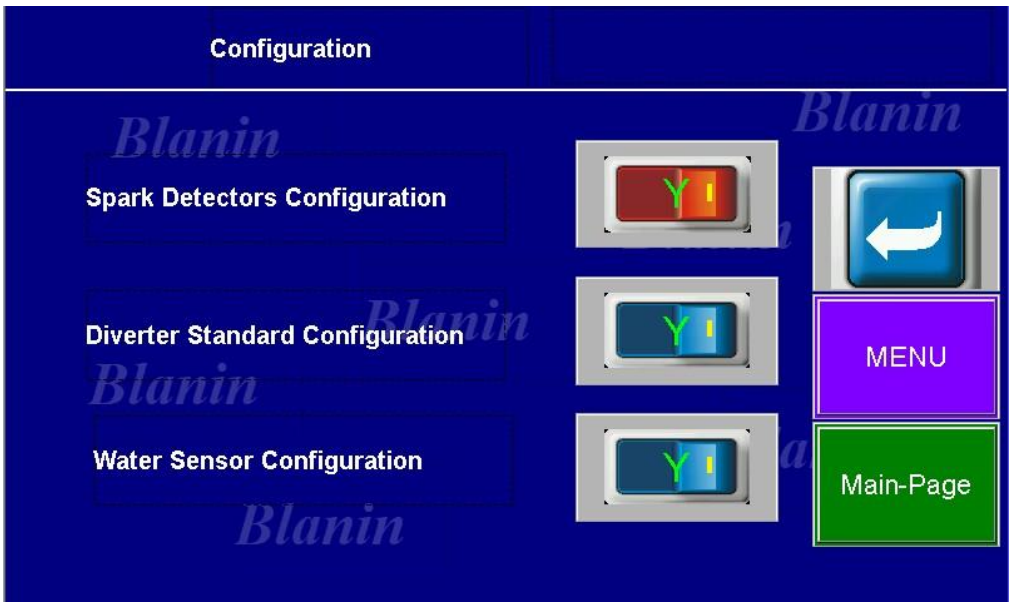


Figure 20. system configuration

ATTENTION

① Advanced password downward compatible with low-level password;

② The password of each level cannot be the same during the process of setting;

③ Users can modify password of level 1, 2 and 3 according to demand.

Password level (high →low)	Factory default password
Level 4 password (administrator)	**1234**
Level 3 password	**33**
Level 2 password	**22**
Level 1 password	**11**

Table 4. password level description

2.3 Record

Click “Record” key and enter into record page.

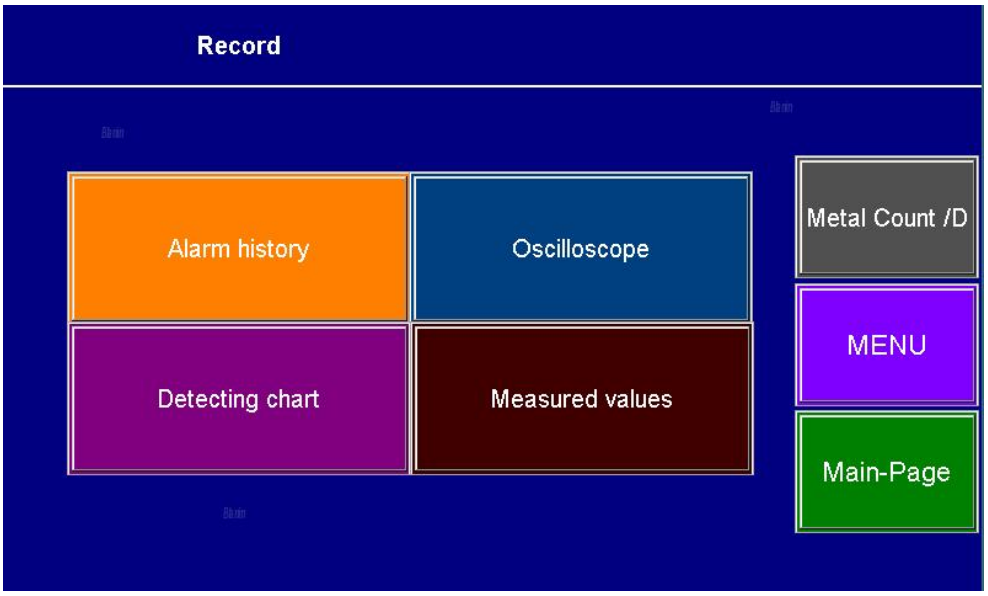


Figure 21. History

1）“Alarm history”: users can check the specific time of each alarm;

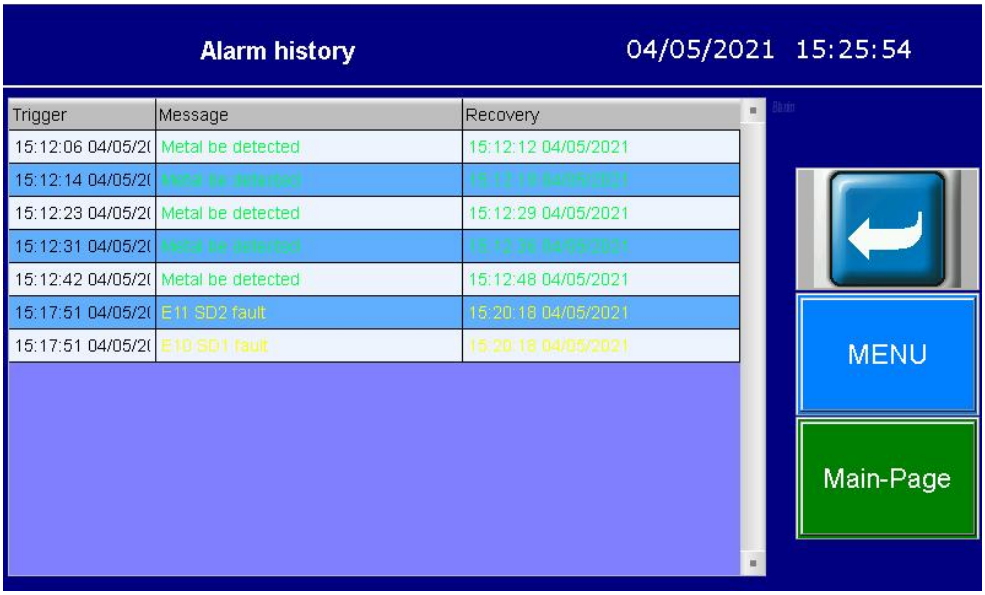


Figure 22: Alarm history

2）Click “ Detecting chart ” key, user can see the metal detection trend chart.

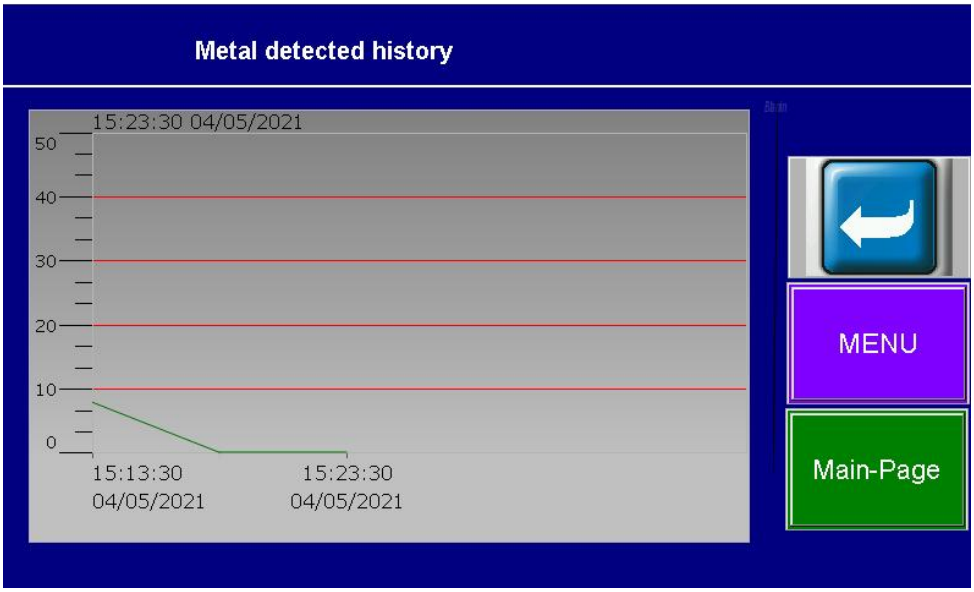


Figure 23: Metal detected history

Click the chart, long press and drag to view the number and time of alarm.

3）Click “Measured values” key and check metal count record for the last four days.

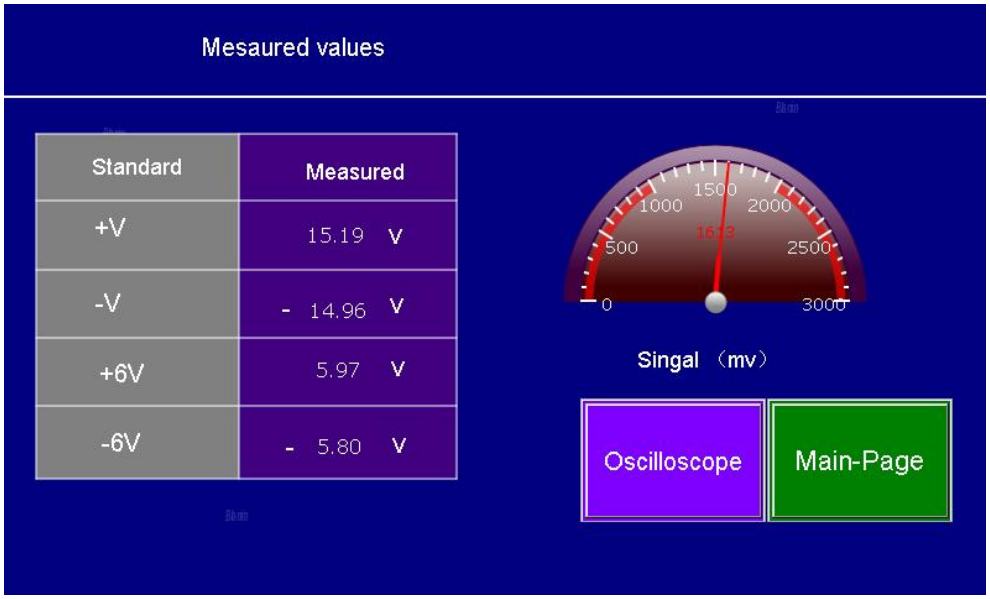


Figure 24:Measured values

4)Click “Oscilloscope” key and enter into the Oscilloscope page.

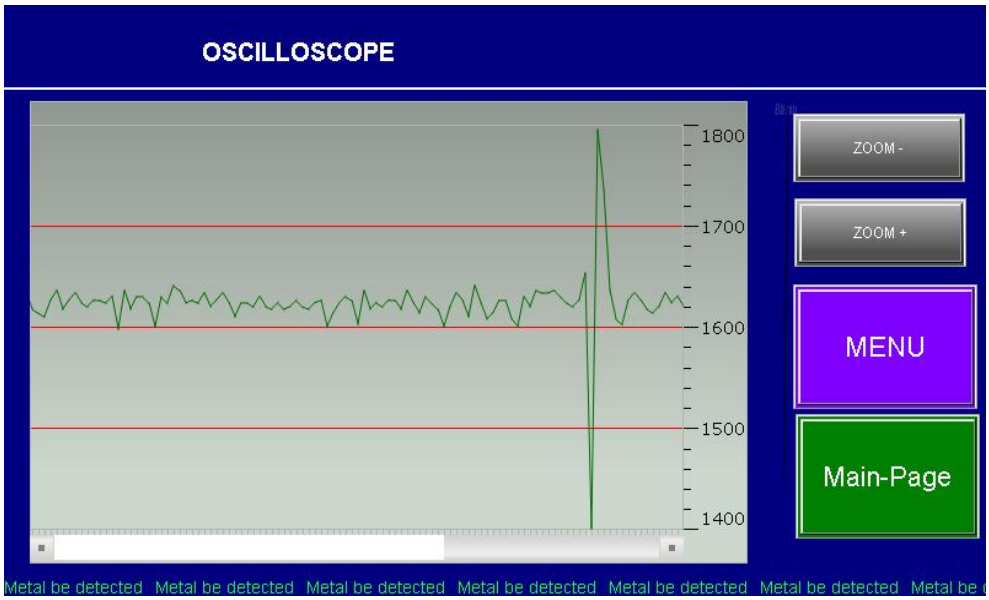


Figure 25: Oscilloscope

2.4 Communication parameter setting

Click “Communication” key, the entry password is level 2 or above all.

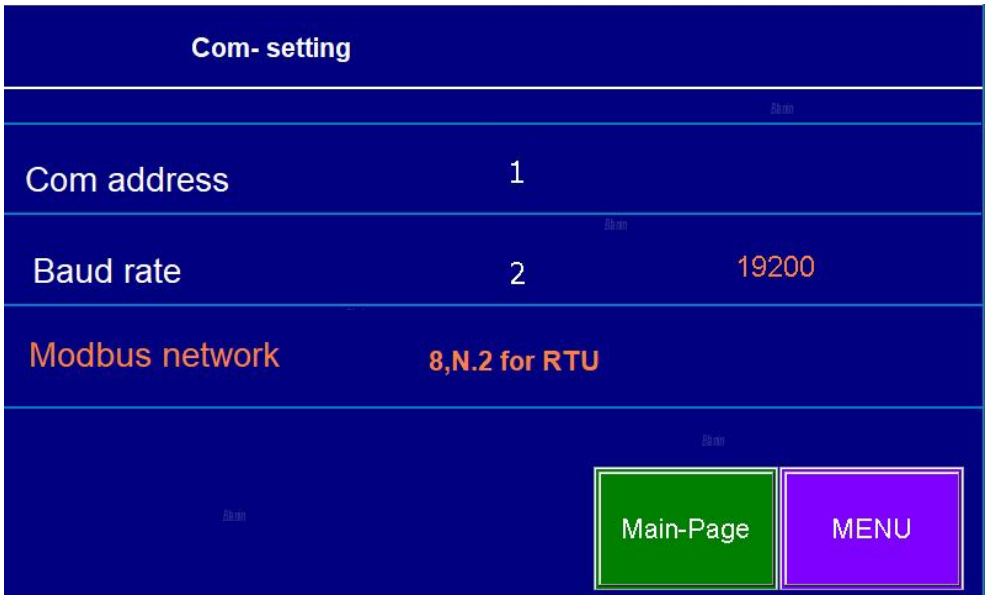


Figure 26. Communication

1.“Com address”: click numbers and modify communication address, range is 1 to 64.

2. “Baud rate” : click numbers and modify baud rate, range is 1 to 3. 1, 2 and 3 correspond to the baud rate 9600, 19200 and 38400 bit/s.

3. “Modbus network” is unmodifiable item, the factory setting is "8, N, 2 for RTU.

3. Communication protocol

3.1 Communication format

11-bit character frame（for RTU）

Start bit	0	1	2	3	4	5	6	7	Stop bit	Stop bit

3.2 Communication protocol RTU mode

START	Keep no input signal greater than or equal to 10ms
address	Communication address
Function	Function code

DATA（n-1）	Contents of data： n×8-bit data
……	
DATA 0	
CRC CHK Low	CRC check sum 16-bit CRC check code consists of two 8-bit combinations
CRC CHK High	
END	Keep no input signal greater than or equal to 10ms

3.3 Local communication protocol parameters address definition

Register data read write (function code 03, 06)	0001H	velocity of metal
	0002H	Sensitivity parameter
	0003H	Metal counts
	0004H	Delay action time parameter
	0005H	Reset time parameter
	0006H	Action time parameter
	0007H	Communication address
	0008H	Baud rate
	0009H	Hardware version
	000AH	Number of faulty spark sensor
	000BH	Number of alarm spark sensor

Coil data read (function code 01)	Bit1	Metal detection
	Bit2	Box full E1
	Bit3	Big metal
	Bit4	act timeout E4
	Bit5	Diverter Flap E5
	Bit6	Pressure low E6
	Bit7	Spark sensor auto test (auto:1)
	Bit8	Chinese/English menu(english:0)
	Bit9	Fire alarm
	Bit10	SD1 is faulty E10
	Bit11	SD2 is faulty E11
	Bit12	--
	Bit13	Function of spark and metal

		detection (standard:0)
	Bit14	--
	Bit15	Function of diverter (standard:0)

Coil data write (function code 05)	Bit1	--
	Bit2	--
	Bit3	--
	Bit4	--
	Bit9	Fire alarm

Force coil bit 9 to OFF state

Function: Reset fire alarm/ Reset part of the fault alarm content

D. Debugging and usage maintenance

1. Fire alarm simulation test

a. You can use the fire alarm testing function brought by the machine itself .See Chapter C Using of the control panel /2.3 Function setting / 4Spark test.

b. There is an active window on the pipe beside the spark diverter. You can also shine the spark detector through the window by torch. If the controller can carry out normal action, the spark diverter function is good.（The tungsten filament of the torch is a hot body and includes infrared ray）When the fire alarm function is activated, it is necessary to reset manually.

c. Spark sensor can be tested automatically, as shown is figure 16. Auto test time can be set.

⚠ **Warning:**

① The spark alarm function should be checked regularly with simulation test to assure that they are in the good working status. It is suggested that the test be carried out at least once every two weeks.

② The dust and fibres on the surface of lens in spark detectors must be regularly checked and cleaned.

2. Metal diverting function test and adjustment

In the meantime of metal diverting function test, it is necessary to do the setting of parameters such as sensitivity, activate, reset and so on.

a. ‘Sensitivity’ setting on the control panel can control the sensitivity of detecting

metal scraps. The higher the sensitivity is, the more sensitive the metal sensor has. You can set the sensitivity according to the actual needs.

b. 'Activate' parameter can adjust the delay time from the metal detector detects the metal to the diverter activated. Thus the parameter is adjusted to minimum 0.00S, and after many times of testing, it is proved to be able to discharge metal scraps correctly. This status indicates that the distance from the metal detector to the diverter is the shortest and it is the most ideal.

c. 'Reset' parameter refers to the delay time of resetting after the action of the diverter. The parameter can directly affect the contaminated material volume. It is best to assure that the metal scraps can be properly discharged but the contaminated material volume is the minimum.

d. While you are carrying out the metal test, please be observant to avoid the metal from entering the blower in the next procedure. You can use spreader tinfoil not less than 1cm^2, otherwise 3mm or smaller screw washer with obvious identification. Then wrap it with cotton and let it be plucked by bale plucker or directly put it into the transport pipe. When the indicator of the control box lights and the diverter actuated, that indicates that the metal detection function of this machine is normal.

e. If the diverter actuated, but you can't find the test metal in the collector box, you should carefully observe and repeatedly adjust Activate and reset parameter until you can reliably divert the test metal. In the meantime, you should assure the dropped volume is the minimum. After repeat test, if you still can't divert properly, it is necessary to reconsider the install distance from metal detector to diverter.

3. Maintenance and inspections

a. The user should make regular check on the functions of the spark detectors and metal detector to assure they are in good working state.

b. The material diverted in the collector box should be emptied timely, or it may damage the diverter.

c. The diverter should also be checked regularly to make sure in the good state.

d. All wire connection and bolt fastener should be checked regularly.

⚠ **Warning:**

The power supply and the Compressed air supply should be shut off while

overhauling the diverter. It can insure the user from unexpected hurt by the movable flap.

4. Debugging

◆ E2

Box full: the collector box is full

1) The collector box is full and needs to be emptied.

2) Check whether the photoelectric switch is working normally.

◆ E4

Act timeout: The flap did not arrive at the activated position in the set time

1) Check whether the components such as the electromagnetic valve, cylinder .etc are working normally; check whether the pressure of compressed air is in the demand range.

2) Check whether the flap had been jammed.

3) If the diverter is normal, check the wiring of the proximity switch and other wires.

◆ E5

Diverter Flap: The flap is not at proper position when it's working.

1) Check whether the flap had been jammed in the abnormal position.

2) Check whether the proximity switch is working and if necessary check the wiring of the proximity switch.

◆ E6

Pressure low: the pressure of compressed air is too low.

1) Check whether the compressed air was supplied normally, or in the demand range.

2) Check whether the pressure switch is working and if necessary check the wiring of the pressure switch.

◆ E10

SD1 error

1) SD1 is not installed

2) The sensitivity of SD1 is too low.

◆ E11

SD2 error

1) SD2 is not installed

2) The sensitivity of SD2 is too low.